INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT

Biosolids Land Application Calculations

Office of Land Quality

(317) 234-6965 • (800) 451-6027   **www.idem.IN.gov**   100 N. Senate Ave., Indianapolis, IN 46204

Area of Rectangle = (Length) (Width)

Application Rate = Amount Applied / [(Length x Width) / 43,560, sq ft/acre]

Biosolids Applied = (N needed – N other) / Biosolids PAN

Dry Tons, acre = (Wet Tons, acre) (Solids Content, in decimal form)

Liquid flow, gpm = Mass rate, lb/min / (% Total Solids) (8.34 lb/gal)

Mass, lbs = (Volume, gal) (% Total Solids) (8.34 lbs/gal)

Mass, lbs = (Volume, MGD) (Concentration, mg/L) (8.34 lbs/gal)

Metals Loading Rate, lb/acre = (Metal Concentration, mg/kg) (0.002) (Dry Tons Biosolids Applied, acre)

Wet Tons, acre = Dry Tons, acre / Solids Content, in decimal form

% Total Solids = 100 - % Moisture

% Dry Nutrients = % Wet (use percentage number) / (% Total Solids / 100)

PCB Value, dry = PCB Wet Value / (% Total Solids / 100)

Dry Tons = $\dfrac{(\text{\# of Gallons Applied x 8.34 lbs/gal x (\% Total Solids / 100)})}{2{,}000}$

% Volatile Solids to mg/l Wet Weight =

(% Total Solids x 10,000 x (% Volatile Solids / 100))

Conversion Factors:

1 acre = 43,560 square feet

1 acre - 0.405 hectare

1 acre-inch = 27,000 gallons

1 gallon = 8.34 pounds

1 metric ton = 2,200 pounds

1 metric ton = 1,000 kilograms

1 mile = 5,280 feet

1 pound = 0.454 kg

1 square mile = 640 acres

1 ton = 2,000 pounds

1% = 10,000 mg/kg or

1% = 10,000 ppm

1% = 20 lb/ton

1 mg/kg = 1ppm

1 mg/kg = 0.0001 %

1 mg/kg = 0.002 lb/ton

Nitrogen loading rates for Biosolids or Industrial Waste Products as specified in the rule 327 IAC 6.1-4-1(a)(1)

(b) The following formulas for PAN loading calculations apply to this article and must be used to calculate the amount of PAN in the biosolid or industrial waste product and the residual available nitrogen at the application site; all calculations are based on a percent dry weight basis:

<u>NITROGEN CALCULATION FORMULAS</u>

GENERAL CALCULATIONS

- % Total Nitrogen = % Total Kjeldahl Nitrogen + % Nitrate Nitrogen
- % Organic Nitrogen = % Total Nitrogen - (% Ammonia Nitrogen + % Nitrate Nitrogen)

PAN CALCULATION FOR AEROBIC BIOSOLIDS

- Pounds Organic Nitrogen per dry ton = % Organic Nitrogen X 6
- Pounds of Ammonia Nitrogen per dry ton = % Ammonia Nitrogen X 20
- Pounds of Nitrate Nitrogen per dry ton = % Nitrate Nitrogen X 20
- Pounds PAN per dry ton = Pounds of Organic Nitrogen per dry ton + Pounds of Ammonia Nitrogen per dry ton + Pounds of Nitrate Nitrogen per dry ton

RESIDUAL NITROGEN CALCULATION FOR AEROBIC BIOSOLIDS

- Pounds of Residual Nitrogen available 1 year after application = % Organic Nitrogen X 3 X dry tons applied per acre
- Pounds of Residual Nitrogen available 2 years after application = % Organic Nitrogen X 1.6 X dry tons applied per acre
- Pounds of Residual Nitrogen available 3 years after application = % Organic Nitrogen X 0.8 X dry tons applied per acre

PAN CALCULATION FOR ANAEROBIC BIOSOLIDS

- Pounds Organic Nitrogen per dry ton = % Organic Nitrogen X 4
- Pounds of Ammonia Nitrogen per dry ton = % Ammonia Nitrogen X 20
- Pounds of Nitrate Nitrogen per dry ton = % Nitrate Nitrogen X 20
- Pounds PAN per dry ton = Pounds of Organic Nitrogen per dry ton + Pounds of Ammonia Nitrogen per

dry ton + Pounds of Nitrate Nitrogen per dry ton

RESIDUAL NITROGEN CALCULATION FOR ANAEROBIC BIOSOLIDS

- Pounds of Residual Nitrogen available 1 year after application = % Organic Nitrogen X 2 X dry tons applied per acre
- Pounds of Residual Nitrogen available 2 years after application = % Organic Nitrogen X dry tons applied per acre
- Pounds of Residual Nitrogen available 3 years after application = % Organic Nitrogen X 0.5 X dry tons applied per acre

Nitrogen loading rates for Pollutant-bearing Water as specified in the rule 327 IAC 6.1-7-10(b)

(b) The following formulas for PAN loading calculations apply to this article and must be used to calculate the amount of

PAN in the pollutant-bearing water and the residual available nitrogen at the application site; all calculations are based on a wet

weight basis in milligrams per liter:

(1) Total N = Total Kjeldahl N + Nitrate N

Indiana Administrative Code Page 57

LAND APPLICATION OF BIOSOLID, INDUSTRIAL WASTE PRODUCT, AND POLLUTANT-BEARING WATER

(2) Organic N = Total N - (Ammonia N + Nitrate N)

(3) Pounds Organic N applied per acre =

(Organic N) × (gallons applied) × (8.34)

(3.33) × (1,000,000) × (acres applied to)

(4) Pounds of Ammonia N applied per acre =

(Ammonia N) × (gallons applied) × (8.34)

(1,000,000) × (acres applied to)

(5) Pounds of Nitrate N applied per acre =

(Nitrate N) × (gallons applied) × (8.34)

(1,000,000) × (acres applied to)

(6) Pounds PAN applied per acre = Pounds of Organic N applied per acre + Pounds of Ammonia N applied per acre +

Pounds of Nitrate N applied per acre

(7) Residual nitrogen from past biosolid or industrial waste products applications:

(A) Pounds of residual N available per acre after one (1) year =

(Organic N) × (gallons applied) × (8.34)

(6.67) × (1,000,000) × (acres applied to)

(B) Pounds of residual N available per acre after two (2) years =

(Organic N) × (gallons applied) × (8.34)

(12.5) × (1,000,000) × (acres applied to)

(C) Pounds of residual N available per acre after three (3) years =

(Organic N) × (gallons applied) × (8.34)

(25) × (1,000,000) × (acres applied to)

Where: N = Nitrogen.

Approved Test Methods

Permittees must use test methods indicated in 327 IAC 6.1 unless otherwise approved in their permit. Some exceptions may be necessary.

Metals: EPA-600/4-91/010 or SW846

Nutrients: EPA-600/4-79-020

PCBs: not specified

Fecal coliform: SM Part 9221E and Part 9222D for Class B biosolids,   SM Part 9221 E for Class A biosolids

Volatile solids (VAR): EPA-625/R-92/013

Volatile solids (PBW): SM Part 2540G

Specific oxygen uptake rate (SOUR): SM Part 2710B

Helminth ova: EPA-600/1-87-014

Enteric viruses: ASTM Designation: D 4994-89

Soil pH: Electrometric method